NOTES ON BASE The base chart was prepared by ACIC with advisory assistance from Dr. Gerard P. Kuiper and his collaborators, D. W. G. Arthur and E. A. Whitaker. DATUM

ing to the mean lunar radius of 1738 kilometers. Elevations are referred to a spherical datum 2.6 kilometers below the mean radius to minimize minus elevation values. The horizontal and vertical positions of features on this chart are based primarily on the positions of 150 lunar eatures measured by J. Franz and computed by Schrutka-Rechtenstamm. This control network is supplemented by ACIC extensions in localized areas. Additional horizontal positions have been selected from the Consolidated Cata-

g of Selenographic Positions by D. W. G. Arthur and

he coordinates of 696 lunar features by R. Baldwin. The

probable error of the control is evaluated at 1000 meters.

The assumed lunar figure is that of a sphere correspond-

All elevations are in meters. They are referenced to the assumed vertical datum unless indicated as relative elevations. The relative elevations of crater rims and other prominences above the surrounding terrain and depths of craters are determined by the shadow measuring technique as refined by the Department of Astronomy, Manchester University, under the direction of Professor Zdeněk Kopal. The probable error of the localized relative elevations is 100 meters in the vicinity of the center of the lunar disk with the magnitudes increasing to 300 meters at 70° departure from the center due to foreshortening. Elevations (referenced to datum)..... Depth of crater (rim to floor).....(400)

Relative Elevations (referenced to surrounding terrain) with direction and extent of measured slope indicated . . . . . CONTOURS

All contours are approximate

Contour interval is 300 meters

exact feature or features named.

the features portrayed.

Feature names were adopted from the 1935 International Astronomical Union nomenclature system as amended by Commission 16 of the I.A.U., 1961 and 1964. Supplementary features are associated with the named features through the addition of identifying letters. Craters are identified by capital letters. Eminences are identified by Greek letters. Names of the supplementary lettered features are deleted

when the association with the named feature is apparent.

A black dot is included, where necessary, to identify the

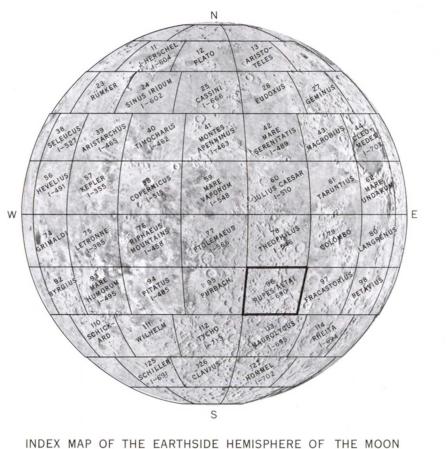
PORTRAYAL

Approximate contour —— —— —— —— ——

Depression contour

The configuration of the lunar surface features shown on the base chart is interpreted from photographs taken at Lick, McDonald, Mt. Wilson, Yerkes, Stony Ridge, Kwasan, and Pic du Midi Observatories. Supplementary visual observations with the 20 and 24 inch refracting telescopes at Lowell Observatory provide identification and clarifiof minute details not recorded photographically. The pictorial portrayal of relief forms is developed using an assumed light source from the West with the angle of illumination maintained equal to the angle of slope of

Crater cluster material Occurs in clustered moderately sharp rimmed, coalescing craters generally 3-6 km in dia meter. Typically elongate to northnorthwest. Concentrated in southern and southeastern parts of Probably clusters of volcanic craters along large crustal structures or locally may be craters formed by impact of ejecta from a large unknown primary impact crater to southsoutheast or northnorthwest (perhaps  $the \ Imbrium \ basin)$ INTERIOR-GEOLOGICAL SURVEY, WASHINGTON, D.C.-1972-G70534 SCALE 1:1 000 000 Lunar base chart LAC 96, 1st edition, 1965, by the USAF Aeronautical Principal sources of geologic information: Lunar Orbiter IV high-resolution Chart and Information Center, St. Louis, Missouri 63118 (identification resolution approx. 90 m) photographs from Langley Research LAMBERT CONFORMAL PROJECTION Center, NASA (see index map); unpublished low-illumination photographs from Lick Observatory, courtesy of G. H. Herbig; high-illumination (nearfull-moon) photographs 5818 and 5819 from U.S. Naval Observatory, Flagstaff, Arizona. Mapped 1967-68 Prepared on behalf of the National Aeronautics and Space Administration



Number above quadrangle name refers to lunar base chart (LAC series);

number below refers to published geologic map

All numbers refer to high-resolution frames of Orbiter IV except LO-V M 54, Orbiter  ${
m V}$ medium resolution. Heavy outline shows Orbiter V frame 54 high-resolution

LUNAR ORBITER PHOTOGRAPHIC COVERAGE OF RUPES ALTAI QUADRANGLE

## GEOLOGIC MAP OF THE RUPES ALTAI QUADRANGLE OF THE MOON

EXPLANATION

Ray material

 $Diffuse\ bright,\ northeast\-trending\ streaks$ 

radial to crater Tycho. Unit Csc occurs

within these streaks. At 90 m resolution,

topography appears subdued within streaks

Material of subdued crater

Smooth-textured material of crater Pons C

which has subdued rim and irregular out-

line. Density of superposed craters low.

Material of volcanic crater, possibly a cinder

Mare material

Forms relatively flat

smooth plains in north-

east corner of quadrangle.

Albedo and crater density

slightly lower than on

Lava flows and probably

Hummocky materials

Ih, hummocky material

Forms hummocky, lo

Density of superposed

moderately high. Unit

Contact with unit I

craters (unit Ich

slightly less abundant

Ih, association of chain

craters and small rille

and the apparent

to Nectaris basin sug-

rather than impact

ejecta from Nectaris

basin. Individual hum-

mocks may be cinde

cones or other volcanic

constructs; in either case, many local sources

are suggested. Queried

either crater ejecta or

pre-Imbrian breccia

Ihf, furrows and pits and

similarity to unit Ih

suggest volcanic origin.

 $ransitional\ contac$ with unit Ih may indi-

cate slightly different

mode of origin; or fur-

rows and pits may be

structures of under-

because of thinner cover

than in unit Ih

gest material is volcani

younger age relative

than on unit Ih

nterpretation

widely distributed in

Contacts with adjacent some pyroclastics; com-

A small pit occurs in floor

lying. Usually occupies

topographic lows in

terra. Crater density

higher than those of

Inresolved ejecta and secondary craters of

relative to unrayed areas

Interpretation

Satellitic crater material of crater Tycho

Occurs in clusters of sharp elongate to cir-

ular craters 1-2 km in diameter. Albedo

high. Clusters usually elongate radial to

Formed by impact of ejecta from the primary

fragments of the ejecta, and tertiary crater

impact crater Tycho; includes breccia

Crater materials

Cc, crater materials, undivided. Craters less than 5 km in diameter having bright  $arcuate\ slump\ zones$ Ccr, rim material. Bright, radially distributed material outside rim crest. No or blocks. Smooth apdetails resolvable at 90 m resolution so pearance at 90 m resolution (Lunar Orbiter that deposit appears smooth Ccw, wall material. Bright, steep slope Loose fragmental at 90 m resolution freshly exposed by

Slope materia

crater Tycho material inside rim crest. Low crater density and hilly or granular appearance Primary craters of impact origin Ccr, ejecta consisting of highly fractured, and probably partly shock-metamorphosed, poorly sorted, bedrock fragments Ccw, fractured, brecciated, shock-metamorphosed material that has slumped in large

masses; probably has a veneer of talus Crater materials

Eratosthenian craters are nonrayed craters whose rim crests are less sharp than those of Copernican craters. The radial rim material facies is only suggested on 15-25 km diameter craters (Abenezra A and Sacrobosco C) at 90 m resolution; internal terraces slightly sub-Ec, crater materials, undivided. Craters too small (<10 km diameter) to subdivide Ecr, rim material. Steeply sloping, smooth to radially ridged topography outside rim crest. Crater density relatively low. Ecw, wall material. Material on steep interior slopes having smooth appearance

and fine lineaments at 90 m resolution.

Ecf, floor material. Smooth, flat-lying

in crater Abenezra A where ridges and lineaments are conspicuous. Albedo in-Interpretation Ec, Ecr, and Ecw same as for Copernican craters, except for age. Floor material probably fragmental material, fine to coarse (up to a few meters), mostly shocked. Larger masses highly brecciated; smaller fragments consist of fallback and material mass-wasted from wall

Crater materials Terra plains materials Ic 2, crater materials, undivided Ip, plains material, flat Icr, rim material. Steeply sloping, smooth to slightly radially ridged topography Icw, wall material. Has faint radial channels and fine, intersecting lineaand albedo slightly ments at 90 m resolution; albedo high Icf<sub>2</sub>, floor material. Topography slightly hummocky and moderately cratered Icp<sub>2</sub>, peak material. Smooth dome flanked by gently undulating topography in units indistinct where position probably basaltic crater Rothmann. Albedo intermediate

Icr<sub>2</sub>, Icw<sub>2</sub>, Icf<sub>2</sub>, similar in origin to younger where it is large. Occurs throughout area crater materials. Peak material may be formed by rebound at time of impact, but commonly closely associated with units possibly aided by inward flow of material Ih, Ihf, and Ich from wall region Ipt, plains material, thin. Forms undulating surunits. Structural features sparse. Crater Crater materials density and albedo similar to unit Ip Ic1, crater materials, undivided Icr, rim material. Similar to upper Im-Ip, morphology, stratitext) with probably vol-

brian rim material but radial ridges absent, non-radial lineaments abundant, and crater density higher Icw1, wall material. Similar to upper Imcanic units suggest brian wall material but radial channels more conspicuous and albedo generally lower; in craters >15 km, coalescing ter-Icf<sub>1</sub>, floor material. Similar to upper Imbrian floor material but crater density Icp,, peak material. Smooth domical peak in floor of crater Tacitus Same as for younger craters except that later cratering events and tectonic move-

ments have modified the component units

and the wall is more modified by slumping

Crater materials

buried by unit Ih

and slump blocks

pIcr3, rim material. Forms cratered,

pIcw3, wall material. Moderately steep

slopes having lineaments, radial channels,

Similar to materials of younger craters

except more highly fractured and deformed

because of longer exposure to tectonic.

volcanic, and impact cratering events. In addition to superposition of regional volcanic materials, transection by dikes and scale. Mass wasting has subdued many cumulated at the base of most steep slopes

pIc , crater materials, undivided. Subdued

pIcr<sub>2</sub>, rim material. Similar to upper pre-

craters too small (<15 km) to be subdivided

Imbrian rim material but density of

craters higher, lineaments more common

pIcw2, wall material. Similar to upper

pre-Imbrian wall material but slopes

slightly lower and terraces, lineaments,

and radial channels more conspicuous

hummocky topography. Queried where

Same as for upper pre-Imbrian crater materials; the modification is more ad-

topography similar to slumped wall ma-

and superposed craters more abundant

pIcf 2, floor material. Hummocky to finely

and rim crests crenulated

broadly hummocky topography; commonly

Crater materials

Characteristics

division

undivided

Either craters are too

small or surrounding

terrain is too complex

to permit further sub-

volcanic origin. Mawest half of area, where terials probably consist individual hummocks are  $\frac{1}{2}-1$  km in diameter. Subdued chain craters and small rilles abunters and pits. Queried dant in the northwest. Queried where topogcrater floor material raphy similar to crater or post-Imbrian volrim material or undivided pre-Imbrian terra Ipt, same as unit Ip, but hf, hummocky material and thinner. Queried where could be furrowed Forms hummocky ma and pitted hummocky terial having numerous material or flat-lying elongate furrows and plains material irregular pits. Densit Some occurrences of both of superposed round units appear to be partly raters same as on unit covered by lower Im-Ih. Confined to northcentral part of the area and could be early Im-

brian in age

Material of subdued Material of elongate craters Characteristics Occurs in elliptical to longate, steep to moderately steep-sided craters having low rims. In some occurrences, several craters coalesce. Distribution restricted gation dominantly north-

Volcanic explosion vents formed along zones of ically deformed crater within the Nectaris basin to other units. Some tectonic province or may be secondary cra-

lescing craters, 4-10 km Occurs in smooth-texsubdued rims and, in chains. Dominant north west trend. Especially abundant in western density relatively low part of area. Individual craters have slightly raised rims, relatively smooth walls and floors, be genetically associated and locally flat floors. Parallel lineaments commonly associated secondary impact craters ters formed by impact Interpretation formed by ejecta from of ejecta from Imbrium Chains of volcanic cra-

craters

gate north-south; linear with the crater chain to curvilinear ridges tangential to Albufeda occur on flanks. The and its extension to conical dome has a summit pit and cleft Interpretation  $Volcanic\ construction a$ ters formed along strucfeatures or topographic tural zones of weakness highs buried by younger ably explosive craters may have a genetic and having associated pyroclastic deposits. Comto hummocky materials. mon association with These domes may be units Ih, Ip, and Ipt  $stratovolcanoes\ composed$ suggest genetic and of intermediate to felsic  $temporal\ relationship$ rocks, whereas the conso that unit Ich may ical dome is probably a be a source vent for the cinder cone. Queried plains materials and where unit could be a hummocky materials. crater remnant Age inferred on basis of this association and  $superposition\ relations$ 

Chain-crater material

Occurs in subdued, coa-

Characteristics

Dome material

Forms low, broad domes

southwest and southeast

of crater Almanon that

are associated with

hummocky materials

Pontanus and Pontanus

of crater Catharina.

The low, broad domes

H, and a small slightly

conical dome southeast

are 10-12 km in diam-

eter and slightly elon-

Characteristics

GEOLOGIC SETTING The Rupes Altai quadrangle of the Moon is in the rugged, cratered terra of the southeastern earthside hemisphere. East-northeast of the quadrangle lies Mare Nectaris, approximately 350 km in diameter, and near the northeast corner is the crater Theophilus. Rupes Altai (the Altai Scarp) divides the quadrangle into two markedly different morphologic provinces. To the west, complexly overlapping, fractured craters are extensively buried by distinctive noncrater units. The area east of the scarp, here referred to as the

bench and trough province, is part of the multi-ringed structure (Nectaris basin) whose deep central part is occupied by Mare Nectaris (Hartmann and Kuiper, 1962) and whose western limit is the scarp. This province is characterized by fewer craters and by benches and troughs which are only shallowly filled. Mare material of Mare Nectaris in contact with the bench and trough materials is locally exposed in the northeast corner of the quadrangle and more extensively just beyond the east border of the quadrangle. In general morphology, the Nectaris basin is similar to the Orientale basin (McCauley, 1968), but the Nectaris ring structures and other features are more subdued. Bright rays and satellitic craters of the relatively young, probable impact craters Tycho and Theophilus cover much of the quadrangle.

No unambiguous stratigraphic datum planes extend from the Rupes Altai quadrangle to the Imbrium basin area, approximately 2,000 km away, where the lunar time-stratigraphic sequence was first defined (Shoemaker and Hackman, 1962; revisions reported by McCauley, 1967, and Wilhelms, 1970). To place the local rock-stratigraphic map units of this quadrangle in this time stratigraphic sequence, relative crater ages were determined and correlated with those established for the Imbrium region. Ages were determined for most of the craters greater than about 3 km in diameter by using criteria established by Pre-Imbrian materials.—The pre-Imbrian materials in the quadrangle consist largely of crater materials and of rugged, highly fractured materials of unknown origin (unit pIu) that occur in the arcuate benches of the bench and trough province and in the conspicuous arc along Rupes Altai. These are the oldest materials in the area and, therefore, constitute the local basement onto which other rock-stratigraphic units were deposited. Because these pre-Imbrian materials generally occur in arcs concentric with the Nectaris basin and parallel to Rupes Altai, they were probably emplaced at the time the basin was formed. Crater materials at least as old as middle pre-Imbrian (unit pIc 2 and its subdivisions) occur on all parts of the bench and trough province and thus indicate that the Nectaris

basin was formed in early pre-Imbrian time. Regional deposits.—Three noncrater regional deposits—hummocky material (unit Ih), furrowed and pitted hummocky material (unit Ihf), and plains material (units Ip and Ipt) are well developed in the area. Because they occur together, they appear to be genetically related and may have formed over a relatively short span of time. The most widely distributed unit, Ih, appears as hummocks or coalescing domes. It is best developed in a broad topographic low in the western part of the area; this broad depression parallels the trends of Rupes Altai and the benches and troughs east of the scarp. The thickness of the hummocky material, estimated from the depth of burial of some craters, appears to reach a maximum of 1 to 2 km in the vicinity of the craters Geber and Azophi. In the southwestern part of the quadrangle, the hummocky material has a slightly finer topographic grain than is typical of the northwest. This slight variation may be due to the presence of a thicker layer of overlying smooth plains material in the southwest. Hummocky material drapes over the rim crests of pre-Imbrian and lower Imbrian craters and, in some craters, inundates the floors. The statigraphic relations combined with the widespread but varying areal distribution and the morphology of the hummocky material suggest that it is a volcanic rock sequence. In the north-central part of the area, hummocky material having furrows and irregular pits occurs in transitional contact with the hummocky material discussed above. This furrowed and pitted hummocky material, unit Ihf, is best exposed north of the craters Fermat C and Sacrobosco F. In addition to the furrows and irregular pits, domes (unit Id) and chain craters (unit Ich) may be indigenous to unit Ihf. In contrast to the low-lying

setting of unit Ih, unit Ihf occurs on high terrain between Rupes Altai and the arcuate, broad depression to the west. The hummocky and furrowed and pitted hummocky materials are similar in morphology, suggesting a common mode of origin-perhaps explosive venting of lava from single and multiple craters, rilles, and cones, with more vents present in unit Ihf. The observed morphologic differences may be manifestations of slight petrologic differences related to the contrasting tectonic settings of the two units, but perhaps the furrows and irregular pits of unit Ihf simply reflect a thinner layer of this material on the underlying surface. The duration of development of the hummocky and furrowed and pitted hummocky materials is difficult to determine but appears to have been short. Upper Imbrian and Eratosthenian crater materials are superposed on the hummocky materials, indicating that the major development took place in Imbrian time. Milton (1968) has mapped similar, but presumably much younger, hummocky materials just north of the furrowed and pitted hummocky material mapped here and called them bright rugged materials of the Kant

of the Moon over an extended period of time. Plains material (units Ip and Ipt) occurs throughout the terra of the Rupes Altai quadrangle. Unit Ip is relatively flat lying and light colored and occurs in topographically low areas. Unit Ipt has undulating topography, is light colored, and occurs both in topographically low areas and on elevated terrain; it appears to be thin deposits of plains material. These materials are typically flat lying and relatively free of structural features at the scale of a few kilometers; a few very low domes and small, highly subdued ring structures too small to map have been observed in unit Ip. The density of craters, especially those 1 to 2 km in diameter, is slightly higher than on the mare (unit Im) of the Nectaris

plateau. Therefore, hummocky materials may have been formed episodically in this region

pitted hummocky materials and occur within lower Imbrian craters and in a few upper mbrian craters. Eratosthenian craters are superposed on the plains. It appears, therefore, that the terra plains materials had their major development in the Imbrian Period, mainly late in that period; perhaps plains material was also deposited locally in early Determination of the relative ages of the terra plains materials and the mare material is critical to understanding the petrogenesis of the regional terra and mare rocks. Because many small craters satellitic to the crater Theophilus are superposed on the mare material, its age is difficult to ascertain. However, apparent superposition of small upper Imbrian and Eratosthenian craters on the mare material places its deposition within the Imbrian Period, close to the time when the two hummocky units and the terra plains materials formed. Because more craters are present on the terra plains than on the mare, an assumed impact origin for most of these craters on the terra plains and mare material and a reasonably constant flux of impacting bodies require a greater age for the plains material

than the mare material. This assumption is suspect, however, inasmuch as the terra and mare volcanic provinces may have markedly different crater populations; a significant number of the small craters on the plains material may be of internal origin and perhaps are the sources for the plains material. The terra plains and mare materials are therefore assigned the same age on the geologic map. Crater materials.—The general aspect of the Rupes Altai quadrangle, as elsewhere in the southern terra of the Moon, is dominated by craters which vary widely in size and degree of freshness. There is a complete morphologic continuum, ranging from sharprimmed, steep-walled craters to relatively shallow craters with pitted and discontinuous rims. This morphologic continuum appears to represent a progressive degradation of craters with increasing age (Pohn and Offield, 1970). In general the lateral extent of

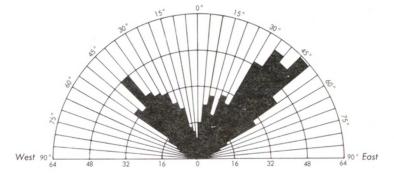
mappable rim deposits of craters of similar size decreases with increasing age, and all crater features become more blurred. The disappearance of distinctive rim and wall characteristics makes subdivision of older craters, especially small ones, difficult or impossible. The features of most young craters suggest an impact origin; although most of the older craters are believed also to be of impact origin, diagnostic criteria are lacking, and some Pre-Imbrian craters are subdivided into three classes which represent interpreted relative ages. From younger to older craters, rim crests grade from slightly rounded and crenulated (upper pre-Imbrian), to highly cratered and fractured (middle pre-Imbrian), to barely discernible or completely obscured (lower pre-Imbrian; none present in this map area). Rim deposits are best preserved in the younger craters and nearly impossible to delineate in the oldest. Wall deposits vary from radially channeled, moderately subdued terraces to hummocky, highly cratered topography; in the oldest craters, radial channels

are moderately to poorly developed. Increasing polygonality is also conspicuous in craters less than 20 km in diameter. Imbrian crater materials are classified into two interpreted ages, lower and upper. Several lower Imbrian craters larger than 15 km in rim-crest diameter are present; all upper Imbrian craters except Rothmann are smaller than 15 km. In craters smaller than 15 km, the distinctive morphologic changes from upper to lower Imbrian are increased rounding of rim crests, higher crater density, particularly on rim deposits, and the prevalence of radial channels in lower Imbrian crater walls. Lower Imbian craters larger than 15 km characteristically have cratered, hummocky rim deposits, round rim crests, and, most diagnostically, coalescing wall terraces. Lower and upper Imbrian craters occur in approximately equal numbers west of Rupes Altai; but to the east, upper Imbrian craters, particularly those less than 10 km in rim-crest diameter, are more numerous. This difference in density is probably due to the widespread development of regional volcanic rocks (units Ip and Ipt) east of Rupes Altai, thereby covering and subduing some of the smaller

Eratosthenian craters lack rays and have sharp rim crests, sharper than those of older craters. Copernican craters, the youngest of all, are topographically very crisp and have Many small, well-formed individual craters and clusters of small secondary craters occur in the northeastern, central, and southern parts of the quadrangle. Most of these craters can be related to the large primary craters Tycho (unit Csc) and Theophilus (not mapped separately), but several clusters of older craters (unit EIcc) are of unknown origin. A few craters have features which are not consistent with any part of the morphologic continuum. Two general types have been recognized: subdued, low-rimmed craters (unit Ics) and elongate to irregular craters (unit Ice). Some of the subdued craters appear to coalesce. A volcanic origin, possibly related to the culmination of the volcanic episode which produced the two hummocky units and the terra plains materials, seems probable for the subdued craters. However, the genesis of the elongate or irregular craters is un-

Numerous chain craters (unit Ich) occur in the quadrangle, especially in association with the two hummocky units. These chain craters typically have subdued rims and coalesce along a linear to curvilinear trend. Because of their temporal and spatial relations with the hummocky and terra plains materials and the great linear extent of some (such as the Abulfeda chain and the chain northeast of the crater Pontanus), it seems probable that these chains are of volcanic origin. There is some doubt, however, concerning their age, because the original morphologic character of craters of this type is poorly known.

The Rupes Altai quadrangle is a fractured area. Fractures range from very large faults, such as Rupes Altai, to numerous small linear valleys and ridges. Rupes Altai has at least 1,000 m local relief and is clearly the most prominent structural feature in the area. It is paralleled by a series of benches and troughs to the east, which lead down to the Nectaris basin; these benches and troughs are probably bounded by faults parallel with the fault defined by Rupes Altai. Immediately west of the main scarp are suggestions of other parallel structures, such as subdued lineaments, broad troughs, and ridges. Linear ridges and valleys commonly extend for only a few kilometers, but some are tens of kilometers long. In general, the dominant trends are northwest and northeast (see lineament diagram), with some scatter about these directions. There is a greater frequency of northeast-trending lineaments than northwest ones. Although Strom (1964) interprets some of the northeast-trending lineaments as structures radial to the Nectaris basin, the lack of other radial directions, such as east and east-northeast, casts some doubt on this interpretation. Basin-formation tectonics may have simply intensified the radial northeast-trending structures in this southwest quadrant of the Nectaris region by causing movements along pre-existing zones of weakness. There was less disruption in the north-



west direction and very little along other trends, which are not radial to the basin.

GEOLOGIC HISTORY The earliest major event recognizable in the Rupes Altai quadrangle is the formation of the Nectaris basin in early pre-Imbrian time; associated faulting is represented by Rupes Altai and parallel features. It is not known whether the basin formed by impact or volcano-tectonic processes, but it is clear that volcanism was widespread after basin formation during the Imbrian Period. Emplacement of hummocky materials of two probably related types was followed, possibly without hiatus, by deposition of terra plains material. Mare materials and terra plains materials may have formed at the same time; thus, since they have different albedos, they may differ in chemical composition. Events of post-Imbrian time were generally restricted to impact cratering, and of these events, only the deposition of ejecta from Tycho and Theophilus had major consequences. Impact cratering has produced a layer of poorly sorted fragmental material, which has been continually redistrib-

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uted through mass wasting.

Survey Prof. Paper 599-F.

or gradational; queried where

Crater materials,

undivided

Materials of markedly

subdued craters which

are either too small

 $(<15 \ km \ in \ diameter)$ 

or too deformed to

subdivide or to permit

more precise age de-

Contact

Dashed where approximately located

Characteristics

termination

Concealed contact Shows limit of topographically expressed buried unit indicated by symbol in parentheses

constructional feature but possibly

a buried fault scarp

Dashed where inferred and exposed; dotted where inferred and buried. Bar and ball on apparent down $thrown\ side$ 

Fault

Terra material, undivided

Forms rugged terrain having high local

relief, conspicuous lineaments, steep slopes

and a high frequency of irregular, subdued

craters. Forms major part of Rupes Altai

and bench areas of Nectaris basin; absent

Includes oldest rocks exposed in area. Com-

ocks highly deformed by tectonic events

associated with formation of Nectaris basin

and subsequent volcanic activity as well as

cratering by impact and by mass wasting

of steeper slopes. Most constituent materials

are probably crater deposits, mainly of

impact origin, but others may be regional

prised mainly of fractured and brecciated

in west half of quadrangle

or exposed

Narrow linear depression

Lineament

Interpretation: Faults, buried

 $(\downarrow\downarrow\downarrow)$ Slump mass shows direction of movement

Narrow trough

Interpretation: May be small rille

or crater chain or possibly a small

sion. Carets point downslope.

Line marks trace of narrow depres-

\_\_\_..\_\_..\_\_..\_\_\_. Buried crater rim crest Indicates approximate line between Narrow and linear or curvilinear Interpretation: Probably a volcanic topographically expressed parts

of buried craters

----+----+------Crater rim crest Line locates crest of crater where two or more craters are mapped as  $same\ unit$ 

\_\_\_\_\_\_ Outer limit of abundant satellitic craters and discontinuous ejecta of crater Theophilus (north of quadrangle)

Line shows plane along which material appears to have moved downslope as a single mass. Arrow

\_\_\_\_

Scarp

Line marks top of Rupes Altai.

Interpretation: Top of fault scarp